

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. Of: PICKARD et al.

Serial No.: 10/677,454

Filed: October 2, 2003

For: HIGH THERMAL CONDUCTIVITY METAL MATRIX COMPOSITES

Group: 1742

Confirmation No. 8506

Examiner: MAI, Ngoclan Thi

DOCKET: MER 03.02

MAIL STOP PETITIONS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

LETTER OF EXPLANATION

Dear Sir:

Applicants respectfully petition to revive the above identified application.

The subject application has been deemed abandoned for failing to properly reply to an Office Action. More particularly, the application was deemed abandoned on the basis that a December 10, 2004 response was not signed by an authorized practitioner, the practitioner who signed the actions having been suspended from practice before the U.S.P.T.O. Actually, on review of the file, it is noted that three amendments were filed by the suspended practitioner.

While Applicants were advised by their former representative that he "had a problem with the Patent Office", Applicants were not aware that their former representative had actually been suspended from practice before the Patent Office or that documents he signed on their behalf were not properly signed. In fact, Applicants were advised by their former representative that he was in the process of resolving things with the Patent Office. Applicants

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have since appointed the undersigned attorney who is in good standing, and who confirms and countersigns the previous submissions by Applicants' former representative.

Applicants never intended to abandon the subject application. In fact, Applicants prosecuted the subject application with the express purpose of obtaining a patent.

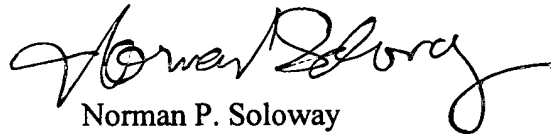
Promptly upon being apprised that their previous representative was suspended from practicing before the U.S.P.T.O., Applicants, through their assignee company, appointed the undersigned attorney. Applicants hereby respectfully petition to revive the subject application.

Accompanying this letter is a confirmatory copy of a Power of Attorney in favor of the undersigned as previously filed, together with a Statement Under 37 CFR 3.73(b), and countersigned copies of the three earlier filed amendments.

Form PTO-2038 authorizing credit card payment of the petition fee (\$750) is enclosed.

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account Number 08-1391.

Respectfully submitted,



Norman P. Soloway
Attorney for Applicant
Reg. No. 24,315

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: MAIL STOP PETITIONS, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on August 23, 2006, at Tucson, Arizona.

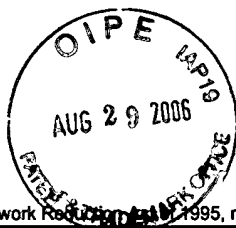
By Kim Hood

NPS:kg

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Doc Code:



PTO/SB/64 (10-05)

Approved for use through 07/31/2006. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Project (37 CFR 1.137(b)), 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED
UNINTENTIONALLY UNDER 37 CFR 1.137(b)**

Docket Number (Optional)
MER 03.02

First named inventor: **PICKARD et al.**

Application No.: **10/677,454**

Art Unit: **1742**

Filed: **October 2, 2003**

Examiner: **MAI, Ngoclan Thi**

Title: **HIGH THERMAL CONDUCTIVITY METAL MATRIX COMPOSITES**

Attention: Office of Petitions

Mail Stop Petition

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

FAX: (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact Petitions
Information at (571) 272-3282.

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:

- (1) Petition fee;
- (2) Reply and/or issue fee;
- (3) Terminal disclaimer with disclaimer fee --required for all utility and plant applications filed before June 8, 1995; and for all design applications; and
- (4) Statement that the entire delay was unintentional.

1. Petition fee

☒ Small entity-fee \$ 750 (37 CFR 1.17(m)). Applicant claims small entity status. See 37 CFR 1.27.

☐ Other than small entity - fee \$ _____ (37 CFR 1.17(m))

2. Reply and/or fee

A. The reply and/or fee to the above-noted Office action in

the form of _____ confirmatory, countersigned Amendments (identify type of reply):

☐ has been filed previously on _____

☒ is enclosed herewith.

607/03/0000 10/01/01 0000000 10077454

03/03/0000

750.00 00

B. The issue fee and publication fee (if applicable) of \$ _____

☐ has been paid previously on _____

☐ is enclosed herewith.

[Page 1 of 2]

This collection of information is required by 37 CFR 1.137(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending on the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code:

PTO/SB/64 (10-05)

Approved for use 07/31/2006. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

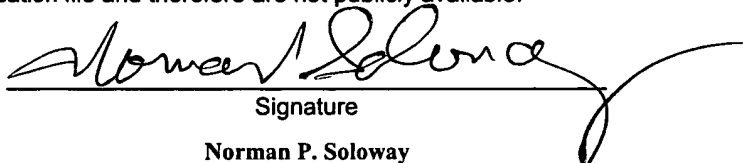
3. Terminal disclaimer with disclaimer fee

- ☒ Since this utility/plant application was filed on or after June 8, 1995, no terminal disclaimer is required.
- ☐ A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of \$ _____ for a small entity or \$ _____ for other than a small entity) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

4. STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional. [NOTE: The United States Patent and Trademark Office may require additional information if there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137(b) was unintentional (MPEP 711.03(c), subsections (III)(C) and (D)).]

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.



Signature
Norman P. Soloway

Typed or printed name
3450 E. Sunrise Drive, Suite 140

Address
Tucson, Arizona 85718

Address

August 23, 2006

Date

24,315
Registration Number, if applicable

520-882-7623
Telephone Number

- Enclosures: ☒ Fee Payment
- ☒ Reply
- ☐ Terminal Disclaimer Form
- ☐ Additional sheets containing statements establishing unintentional delay
- ☐ Other: _____

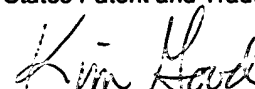
CERTIFICATE OF MAILING OR TRANSMISSION [37 CFR 1.8(a)]

I hereby certify that this correspondence is being:

- ☒ deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
- ☐ Transmitted by facsimile on the date shown below to the United States Patent and Trademark Office at (571) 273-8300.

August 23, 2006

Date



Signature

Kim Good
Type or printed name of person signing certificate



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: PICKARD et al.

Serial No: 10/677,454

Group No: 1742

Filed: October 2, 2003

Examiner: MAI, Ngoclan Thi

For: HIGH THERMAL CONDUCTIVITY METAL MATRIX COMPOSITES

Attorney Docket No.: MER 03.02

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

**POWER OF ATTORNEY BY ASSIGNEE OF ENTIRE INTEREST
AND REVOCATION OF PRIOR POWERS**

As assignee of record of the entire interest of the above-identified application, all powers of attorney previously given are hereby revoked and the following attorneys are hereby appointed to prosecute and transact all business in the Patent and Trademark Office connected therewith:

HAYES SOLOWAY P.C., a firm composed of Oliver W. Hayes, Reg. No. 15,867; Todd A. Sullivan, Reg. No. 47,117; or any of them, of 175 Canal Street, Manchester, New Hampshire 03101 (Telephone: 603-668-1400); or Norman P. Soloway, Reg. No. 24,315; or Ashley L. Kirk, Reg. No. 51,261, or any of them, of 3450 E. Sunrise Drive, Suite 140, Tucson, Arizona 85718 (Telephone: 520-882-7623) or any of them.

Please direct all future correspondence in connection with this application to the attention of **Norman P. Soloway**, HAYES SOLOWAY P.C., 3450 E. Sunrise Drive, Suite 140, Tucson, Arizona 85718 (Telephone: 520-882-7623). Please direct telephone calls to Norman Soloway.

MATERIALS AND ELECTROCHEMICAL RESEARCH (MER) CORPORATION
(Type or print identity of assignee of entire interest)

7960 South Kolb Road

Tucson, Arizona 85706

Address

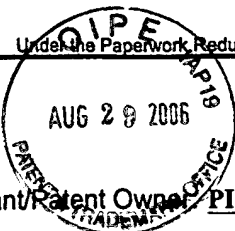
☒ Recorded in U.S. Patent Office on October 2, 2003 Reel 014570 Frame 0988

Attached to this power is a "CERTIFICATE UNDER 37 CFR 3.73(b)."

☐ Recorded herewith

Signature: R. O. Loutfy Date: 07/17, 2006

Name: Raouf O. Loutfy Title: President
(type or print name and title of person authorized to sign on behalf of assignee)

**STATEMENT UNDER 37 CFR 3.73(b)**Applicant/Patent Owner: **PICKARD et al.**Application No./Patent No./Control No.: **10/677,454** Filed/Issue Date: **October 2, 2003**Entitled: **HIGH THERMAL CONDUCTIVITY METAL MATRIX COMPOSITES****Materials and Electrochemical Research Corp.**, a **corporation**

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
The extent (by percentage) of its ownership interest is _____ %

in the patent application/patent identified above by virtue of either:

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at **014570**, Frame **0988**, or a true copy of the original is attached.

OR

- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.
3. From: _____ To: _____
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Reel _____, Frame _____, or for which a copy thereof is attached.

- ☐ Additional documents in the chain of title are listed on a supplemental sheet.

As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

R.O. Loutfy
Signature

Raouf O. Loutfy

Printed or Typed Name

President

Title

07/17/2006
Date

520-574-1980 ext. 112
Telephone number



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Pickard et al.
Serial No.: 10/677,454
Filed: October 2, 2003

Docket No.: 7000Z
Group Art Unit: 1742

For: High Thermal Conductivity Metal Matrix Composites

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

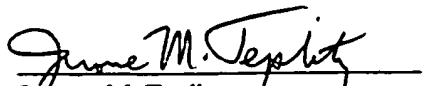
This is in response to the Office Action dated November 8, 2004.

In response to the Examiner's restriction requirement, Applicants elect without traverse to prosecute the invention of Group I, claims 1-4, 17-20, 39, 41-45, 51-96 and 107-135, drawn to a composite.

With respect to the election of species requirement, Applicants elect for prosecution on the merits the species designated by the Examiner as species (i), directed to the composite wherein the metal matrix is aluminum. The claims readable on the elected species are claims 1-3, 17-20, 39, 41-45, 51-58, 67-81, 90-96, 107, 108, 111, 112, 115, 116, 118-122, 125, 126, 129, 130 and 132-135.

CERTIFICATE OF MAILING (37 CFR 1.8)

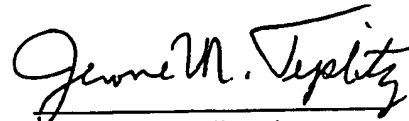
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on December 6, 2004.


Jerome M. Teplitz

December 6, 2004
Date

An early action on the merits of all the claims listed above as being readable on the elected species, is respectfully solicited.

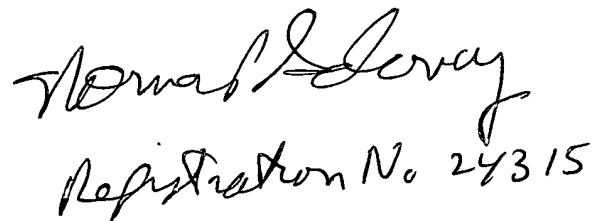
Respectfully submitted,



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August 23, 2006



Registration No. 24315

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Pickard et al
Serial No.: 10/677,454
Filed: October 2, 2003

Docket No.: 7000Z
Group Art Unit: 1742
Examiner: Ngocian T. Mai

For: High Thermal Conductivity Metal Matrix Composites

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

This is in response to the Office Action dated March 10, 2005.

CERTIFICATE OF MAILING (37 CFR 1.8)

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Jerome M. Teplitz
Jerome M. Teplitz

August 10, 2005
Date

SPECIFICATION AMENDMENTS

Page 16, please replace the first paragraph with the following replacement paragraph, marked up to indicate the changes:

The reaction between the diamond and SiO to form SiC coated diamond will generally proceed more rapidly as the process temperature is increased. However at a certain temperature threshold, the diamond can be converted to graphite. In order to establish the limiting conditions in the apparatus in FIG. 1, the following experiments were conducted. Diamond particulate (Synthetic Diamond from Oshmens Corp.) was placed in a crucible and heated to 1550 degrees centigrade and 1600 degrees centigrade for up to 4 hours. X-ray diffraction (XRD) of the heat treated powders indicated the pattern for diamond, with no evidence of graphite. In a separate experiment, diamond powder, which had been reacted with SiO (Table H III, Experiment 4), was heated to 1660 degrees centigrade for 3 hours. The XRD pattern gave no indication of any Conversion of diamond to graphite. However, when the same powder was heated to 1800 degrees centigrade for 8 hours, the XRD pattern on this sample showed a large graphite peak, a broadened diamond peak, and a SiC peak from the SiC conversion reaction. The significant conversion of diamond to graphite after 8 hours at 1800 degrees centigrade led to a decision to restrict the diamond-SiO reactions to lower time and/or temperature.

Page 17, please replace the first paragraph with the following replacement paragraph, marked up to indicate the changes:

Diamond powder of varying particle size, from 0.5 microns to 120 microns, was reacted at temperatures ranging from 1450 degrees centigrade to 1600 degrees centigrade for times of 1-8 hours. The coated diamond particles were then examined by XRD. ~~The XRD pattern for diamond is shown in FIG. 3, and the pattern for beta-SiC in FIG. 4.~~ The experiments are summarized in Table H III. The XRD spectra of the diamonds showed a change that is attributed to the presence of a small concentration of SiC. ~~FIG. 5 is an example of the XRD of such a coating run, example 13 from Table III, wherein diamond powder with a 100-120 micron particle size was reacted with SiO for 3 hours at 1550 degrees centigrade.~~

paragraph, marked up to indicate the changes:

The last column of Table III shows the ratio of the peak height for beta-SiC at $2\theta = 35.7$ to the peak height for diamond at $2\theta = 44.0$. While the ratio of peak heights from XRD is not a quantitative procedure for compositional analysis, it allows a rough estimate of relative (but not absolute) SiC to diamond content in the reacted powders. The data in Table H III indicates the variable with the largest impact on SiC formation is the particle size of the diamond. The peak height ratio of SiC to diamond is generally 0.01-0.04 for 100-120 micron diamond particles, 0.03-0.07 for 15-30 micron diamond, and 0.1-0.6 for 0.5 -2 micron diamond. Thus the largest diamond particles appear to have the lowest SiC content. For a given particle size diamond, increasing the temperature and time for the reaction generally results in a higher ratio of SiC peak height to diamond peak height. Given this information, and the supposition of this invention, it would be expected that the highest thermal conductivity for a composite would be obtained using the diamonds which have the lowest ratio of SiC XRD peak height to diamond XRD peak height. One such diamond powder would be from Experiment 4, Table III, with a particle size of 100-120 microns, and reacted for 3 hours at 1550 degrees centigrade with SiO. Conversely, the diamond powder with a particle size of 0.5-2.0 microns could be expected to produce composites with the lowest thermal conductivity.

CLAIM AMENDMENTS

(1) (currently amended): A composite structure comprised of a metal matrix having diamond particles dispersed therein, wherein said diamond particles are characterized by the presence of a layer of beta-SiC chemically bonded to the surface thereof, said composite structure having a thermal conductivity greater than about 300W/m.k.

(2) (original): The structure of claim 1, wherein the metal matrix is comprised essentially of a metal selected from aluminum, copper, magnesium, and alloys of one or more of said metals.

(3) (original): The structure of claim 1 wherein the metal matrix material is essentially aluminum.

(4) (withdrawn): The structure of claim 1 wherein the metal matrix material is essentially copper.

(5 – 16) (canceled)

(17) (original): The structure of claim 1 wherein the carbon of the SiC is derived from the respective diamond particles to which it is bonded.

(18) (original): The structure of claim 1 wherein the diamond particles are in the size range of 100 - 120 microns.

(19 – 40) (canceled)

41) (currently amended): The composite described in claim 39 74, wherein the temperature to which the preform is heated is at least 1300 degrees centigrade.

42) (currently amended): The composite described in claim 39 74, wherein the temperature to which the preform is heated is at least 1400 degrees centigrade.

43) (currently amended): The composite described in claim 39 74, wherein the temperature to which the preform is heated is at least 1500 degrees centigrade.

44) (currently amended): The composite described in claim 39 74, wherein the temperature to which the preform is heated is at least 1600 degrees centigrade.

45) (currently amended): The composite described in claim 39 74, wherein the temperature to which the preform is heated is at least 1700 degrees centigrade.

46 – 50) (canceled)

51) (original): A metal matrix composite comprising a matrix containing diamond powder, said diamond powder having a thin SiC surface layer on the respective diamond particles comprising said powder, said SiC layers being comprised of a conversion coating formed by a chemical vapor reaction of SiO with the respective diamond particles, and said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

52) (original): The composite described in claim 51, having a thermal conductivity greater than about 400W/m.k.

53) (original): The composite described in claim 51, having a thermal conductivity greater than about 500W/m.k.

54) (original): The composite described in claim 51, having a thermal conductivity greater than about 600W/m.k.

55) (original): The composite of claim 51, wherein the metal employed is aluminum.

56) (original): The composite of claim 52, wherein the metal employed is aluminum.

57) (original): The composite of claim 53, wherein the metal employed is aluminum.

58) (original): The composite of claim 54, wherein the metal employed is aluminum.

- 59) (withdrawn): The composite of claim 51, wherein the metal employed is magnesium.
- 60) (withdrawn): The composite of claim 52, wherein the metal employed is magnesium.
- 61) (withdrawn): The composite of claim 53, wherein the metal employed is magnesium.
- 62) (withdrawn): The composite of claim 54, wherein the metal employed is magnesium.
- 63) (withdrawn): The composite of claim 51, wherein the metal employed is copper.
- 64) (withdrawn): The composite of claim 52, wherein the metal employed is copper.
- 65) (withdrawn): The composite of claim 53, wherein the metal employed is copper.
- 66) (withdrawn): The composite of claim 54, wherein the metal employed is copper.
- 67) (currently amended): The composite described in claim 51, wherein the content of the C_{VR} SiC coated diamond powder in the composite is about 10-60 vol% of the total.
- 68) (currently amended): The composite described in claim 51, wherein the content of the C_{VR} SiC coated diamond powder in the composite is greater than about 70 vol% of the total.
- 69) (currently amended): The composite described in claim 51, wherein the content of the C_{VR} SiC coated diamond powder in the composite is greater than 80 vol% of the total.
- (70) (currently amended): The composite described in claim 51, wherein the particle size of the diamond powder used is preferably about 50-150 microns [[, and more preferably 100-120 microns]].
- (71) (original): The composite described in claim 51, wherein the particle size of the diamond powder used is preferably greater than 150 microns.
- (72) (original): The composite described in claim 51, wherein the particle size of the diamond powder is greater than about 200 microns.

(73) (original): The composite described in claim 51, wherein the particle size of the diamond powder is greater than about 300 microns.

(74) (currently amended): A metal matrix composite containing diamond powder, said diamond powder comprising diamond particles having a thin SiC surface conversion layer coating formed thereon, such layer coating being formed by heating a preform of Si powder and diamond powder plus a binder, [[such as, but not limited to, phenolic resin,]] the purpose of said binder being to hold the Si in contact with the surface of the respective diamond particles, heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, and said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

(75) (original): The composite described in claim 74, having a thermal conductivity greater than about 400W/m.k.

(76) (original): The composite described in claim 74, having a thermal conductivity greater than about 500W/m.k.

(77) (original): The composite described in claim 74, having a thermal conductivity greater than about 600W/m.k.

(78) (original): The composite described in claim 74, wherein metal comprising the matrix is aluminum

(79) (original): The composite described in claim 75, wherein the metal comprising the matrix is aluminum.

(80) (original): The composite described in claim 76, wherein the metal comprising the matrix is aluminum.

(81) (original): The composite described in claim 77, wherein the metal comprising the matrix is aluminum.

(82) (withdrawn): The composite described in claim 74, wherein the metal comprising the matrix is magnesium.

(83) (withdrawn): The composite described in claim 75, wherein the metal comprising the matrix is magnesium.

(84) (withdrawn): The composite described in claim 76, wherein the metal comprising the matrix is magnesium.

(85) (withdrawn): The composite described in claim 72, wherein the matrix metal is copper.

(86) (withdrawn): The composite described in claim 74, wherein the matrix metal is copper.

(87) (withdrawn): The composite described in claim 75, wherein the matrix metal is copper.

(88) (withdrawn): The composite described in claim 76, wherein the matrix metal is copper.

(89) (withdrawn): The composite described in claim 77 wherein the matrix metal is copper.

(90) (currently amended): The composite described in claim 74, wherein the content of the ~~CVR~~ SiC coated diamond powder in the composite is about 10-60 vol% of the total.

(91) (currently amended): The composite described in claim 74, wherein the content of the ~~CVR~~ SiC coated diamond powder in the composite is greater than about 70 vol% of the total.

(92) (currently amended): The composite described in claim 74, wherein the content of the CVD SiC coated diamond powder in the composite is about greater than about 80 vol% of the total.

(93) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is preferably about 50-150 microns.

(94) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 150 microns.

(95) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 200 microns.

(96) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 300 microns.

(97 – 106) (canceled)

(107) (currently amended): A high thermal conductivity substrate for LDMOS electronic packages, wherein the substrate is a metal matrix composite comprising a metal containing dispersed therein diamond particulates which have a thin SiC coating, said coating having been produced by a chemical vapor reaction process between gaseous SiO and the respective diamond particles, said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

(108) (original): The substrate of claim 107, wherein the metal employed for the metal matrix is aluminum.

(109) (withdrawn): The substrate of claim 107, wherein the metal employed for the metal matrix is magnesium.

(110) (withdrawn): The substrate of claim 107, wherein the metal employed for the metal matrix is copper.

(111) (original): The substrate of claim 107, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(112) (currently amended): The substrate of claim ~~107~~ 111, wherein the metal employed for the metal matrix is aluminum.

(113) (withdrawn): The substrate of claim ~~107~~ 111, wherein the metal employed for the metal matrix is magnesium.

(114) (withdrawn): The substrate of claim ~~107~~ 111, wherein the metal employed for the metal matrix is copper.

(115) (currently amended): An electronic package containing an LDMOS chip bonded to a substrate with very high thermal conductivity, wherein said substrate is a metal matrix composite containing particulate diamond, and said particulate diamond has a thin SiC surface coating formed on the respective particles thereof by a chemical vapor reaction process between gaseous SiO and said diamond powder, said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

(116) (original): The electronic package described in claim 115, wherein the metal employed for the metal matrix is aluminum.

(117) (withdrawn): The electronic package described in claim 115, wherein the metal employed for the metal matrix is copper.

(118) (original): The electronic package described in claim 115, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(119) (currently amended): The electronic package described in claim ~~115~~ 116, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(120) (withdrawn): The electronic package described in claim ~~96~~ 117, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(121) (currently amended): A high thermal conductivity substrate for LDMOS electronic packages, wherein the substrate is a metal matrix composite containing diamond particulates which have a thin SiC conversion coating, such coating being formed by heating a preform of Si powder and diamond powder plus a binder, [[such as, but not limited to, phenolic resin,]] the purpose of said binder being to hold the Si in contact with the diamond surface, and heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

(122) (original): The substrate of claim 121, wherein the metal employed for the metal matrix is aluminum.

(123) (withdrawn): The substrate of claim 121, wherein the metal employed for the metal matrix is magnesium.

(124) (withdrawn): The substrate of claim 121, wherein the metal employed for the metal matrix is copper.

(125) (original): The substrate of claim 121, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(126) (currently amended): The substrate of claim ~~124~~ 125, wherein the metal employed for the metal matrix is aluminum.

(127) (withdrawn): The substrate of claim ~~124~~ 125, wherein the metal employed for the metal matrix is magnesium.

(128) (withdrawn): The substrate of claim ~~124~~ 125, wherein the metal employed for the metal matrix is copper.

(129) (currently amended): An electronic package containing an LDMOS chip bonded to a substrate with very high thermal conductivity, wherein said substrate is a metal matrix composite containing diamond particulates which have a thin SiC conversion coating, said coating being formed by heating a preform of Si powder and diamond powder plus a binder, [[such as, but not limited to, phenolic resin,]] the purpose of said binder being to hold the Si in contact with the diamond surface, and heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, said metal matrix composite having a thermal conductivity greater than about 300W/m.k.

(130) (original): The electronic package described in claim 129, wherein the metal employed for the metal matrix is aluminum.

(131) (withdrawn): The electronic package described in claim 129, wherein the metal employed for the metal matrix is copper.

(132) (original): The electronic package described in claim 129, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(133) (currently amended): The electronic package described in claim ~~129~~ 130, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(134) (withdrawn): The electronic package described in claim ~~129~~ 131, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(135) (original): An electronic package for high power applications, requiring very high thermal dissipation, comprising a composite structure as defined in claim 1 having a high thermal conductivity further characterized by the presence of a layer of aluminum nitride deposited on the surface thereof, said aluminum nitride providing an electrically insulating layer and also providing a high thermal conductivity path allowing for electronic chips to be bonded to the electrically insulating aluminum nitride layer, and also allowing electronic circuitry to be formed or deposited on the aluminum nitride.

(136 – 139) (canceled)

(140) (new): The structure of claim 1, having a thermal conductivity greater than about 400W/m.k.

(141) (new): The structure of claim 1, having a thermal conductivity greater than about 500W/m.k.

(142) (new): The structure of claim 1, having a thermal conductivity greater than about 600W/m.k.

(143) (new): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(144) (new): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(145) (new): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(146) (new): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(147) (new): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(148) (new): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(149) (new): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(150) (new): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(151) (new): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(152) (new): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(153) (new): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(154) (new): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

REMARKS

The present amendments to the specification correct obvious typographical errors on page 16, line 9, page 17, line 5, and page 18, line 5, regarding the Table number referred to thereat. They also eliminate the two sentences on page 17, lines 3-4 and 6-9, inadvertently referring to drawing figures 3, 4 and 5, which were not intended to be included as part of the present application, as is readily apparent from the brief description of the drawings on page 7, lines 9-14.

By means of the present claim amendments, the non-elected process claims 5-16, 21-38, 40, 46-50, 97-106 and 136-139, as well as product claims 19, 20 and 39, have all been canceled and replaced by newly presented product claims 140-154. Also, claims 120 and 134 have been amended to change their dependencies to non-elected species claims 117 and 131, respectively. Hence, the claims currently on file and readable on the elected species are claims 1-3, 17-18, 41-45, 51-58, 67-81, 90-96, 107-108, 111-112, 115-116, 118-119, 121-122, 125-126, 129-130, 132-133, 135 and 140-154; and those withdrawn as not readable on the elected species are claims 4, 59-66, 82-89, 109-110, 113-114, 117, 120, 123-124, 127-128, 131 and 134.

As now amended, claims 112, 119, 126 and 133-134 have all had their dependencies changed so that they no longer are substantial duplicates of claims 108, 118, 122 and 132, respectively. Also, claims 70, 67-69, 90-92 and 120 have now been amended to overcome the Examiner's rejections under 35 U.S.C. 112, second paragraph. Specifically, the narrower diamond particle size range has been eliminated from claim 70,

and along the same lines, the "such as" language has been eliminated from claims 74, 121 and 129. Claims 67-69 and 90-92 have been amended to eliminate the term "CVR" therefrom, and claim 74 has been amended to change the word "layer" to "coating" in lines 2 and 3 thereof so as to provide proper antecedent basis for the recitation "SiC coated diamond powder" in its dependent claims 90-92. Claim 120 has been amended to change its dependency to a parent claim drawn to an electronic package.

Claim 19, rejected by the Examiner under 35 U.S.C. 102(b) as being anticipated by Yu et al., has been canceled.

The present invention is directed to a metal matrix composite material exhibiting an exceptionally high thermal conductivity, and the use of such composite material as a substrate for LDMOS electronic packages. The composite material is comprised of a metal matrix, such as aluminum, having diamond particles dispersed therein, the diamond particles having a SiC surface conversion coating formed thereon. The processing techniques disclosed by Applicants for forming the SiC conversion coating on the diamond particles, and then incorporating the SiC coated diamond particles into the metal matrix, produce a metal matrix composite material exhibiting thermal conductivities greater than about 300W/m.k. to greater than about 600W/m.k. All of the claims presently pending in the application, including newly submitted claims 140-154, require that the composite material has a thermal conductivity within such range.

Of the presently pending claims readable on the elected species, claims 1-3, 17-18, 41-45, 51-58, 67, 70-81, 90, 93-96, 107-108, 111-112, 121-122 and 125-126 stand rejected under 35 U.S.C. 102(e) as being anticipated by Miyamoto et al.; claims 68-69 and 91-92 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Miyamoto et

al. in view of McCoy; claims 115-116, 118-119, 129-130 and 132-133 stand rejected under 35 U.S.C. 103(a) as being unpatentable over McCoy in view of Miyamoto et al.; and claim 135 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Anshel et al. in view of Miyamoto et al. All of these grounds of rejection are respectfully traversed.

The principal reference relied upon by the Examiner in each of these grounds of rejection, is the Miyamoto et al. U.S. Patent No. 6,673,439. Miyamoto et al. disclose metal matrix composite materials containing SiC coated diamond particles dispersed in a metal matrix such as aluminum. According to the Miyamoto et al. process for preparing the SiC coated diamond particles, a SiC surface conversion coating is formed on the diamond particles through the vaporization of solid phase silicon monoxide. The SiC coated diamond particles are then incorporated into the metal matrix by conventional powder metallurgy processing techniques, as illustrated in Example 3 of the patent.

In Example 3, Miyamoto et al. compare SiC coated diamond particles prepared according to their conversion coating process (Inventive Example 2 in Table 1 in Example 1), with those prepared by the prior art chemical vapor deposition (CVD) process (Comparative Example 5 in Table 1 in Example 1), in the production of aluminum metal matrix composite materials. Although the patent states that the composite material employing the conversion coated diamond particles has an excellent thermal conductivity that is approximately three times as high as the thermal conductivity of the composite material employing the CVD coated diamond particles, the patent is completely silent as to any actual thermal conductivity values.

This deficiency in the Miyamoto et al. patent was recognized by the Examiner, in the first complete paragraph on page 6 of the Office Action, with respect to the thermal conductivity limitations recited in claims 51-54 and 74-77, requiring that the instantly claimed composite material has a thermal conductivity ranging from greater than about 300W/m.k. to greater than about 600W/m.k. As noted above, all of the claims presently pending in the application now contain such requirement. The Examiner's position in this regard was that these thermal conductivity limitations appeared to be a material property inherently possessed by the teachings of the reference, and that the burden is on Applicants to prove that the composite materials as described in the Miyamoto et al. patent do not necessarily or inherently possess these characteristics.

Accordingly, Applicants are submitting herewith the Declaration Under 37 CFR 1.132 of Roger S. Storm. Dr. Storm's Declaration documents the steps taken, under his supervision and direction, to duplicate the two metal matrix composite materials containing SiC coated diamond particles as described in Example 3 of the Miyamoto et al. patent, and have their thermal conductivity properties measured. In an effort to optimize these properties, based upon past composite forming experience, Dr. Storm even went so far as to substitute the high pressure squeeze casting process in place of the powder metallurgy process employed by Miyamoto et al. for forming the composites. Even so, the thermal conductivity values obtained for the two resulting composite products were only 141W/m.k. for the product containing the conversion coated diamond particles, and 143W/m.k. for the product containing the CVD coated diamond particles, both far below the thermal conductivity values ranging from greater than about 300W/m.k. to greater than about 600W/m.k. now specified in all of the presently pending

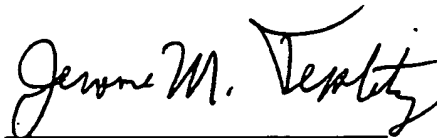
claims. Hence, these thermal conductivity limitations are not a material property inherently possessed by the teachings of the reference, and thus serve to patentably distinguish the instant claims over the Miyamoto et al. patent.

Combining Miyamoto et al. with either McCoy or Anschel et al., does nothing to remedy the deficiencies of the Miyamoto et al. patent in rendering obvious the subject matter of the present claims. The metal matrix composite material taught by McCoy is, at best, nothing more than the composite material containing CVD coated diamond particles discussed above. See McCoy, column 4, lines 35-36. The heat sink components taught by Anschel et al. are merely aluminum or tin-plated copper devoid of any diamond particles, coated or otherwise. See Anschel et al., column 4, lines 39-44.

Hence, all of the presently pending claims clearly patentably distinguish over Miyamoto et al., alone or in combination with either McCoy or Anschel et al. These grounds of rejection should all therefore be withdrawn.

For the foregoing reasons, it is submitted that claims 1-4, 17-18, 41-45, 51-96, 107-135 and 140-154, all of the claims remaining in the case, are allowable, and that the application is now in condition for allowance. Reconsideration by the Examiner and an early notice of allowance are, therefore, respectfully solicited.

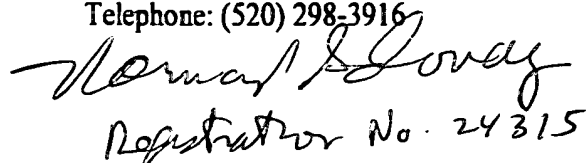
Respectfully submitted,



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August 10, 2005

August 23, 2006



Registration No. 24315



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Pickard et al.
Serial No.: 10/677,454
Filed: October 2, 2003

Docket No.: 7000Z
Group Art Unit: 1742
Examiner: Ngocian T. Mai

For: High Thermal Conductivity Metal Matrix Composites

DECLARATION UNDER 37 CFR 1.132 OF ROGER S. STORM

I, Roger S. Storm, hereby declare that:

1. I reside at 4421 N. Palisade Drive, Tucson, Arizona 85749.
2. I earned a B.A. in Chemistry in 1964 from SUNYAB, and a Ph.D. in Physical Chemistry in 1969 from SUNYAB.
3. I have had over 40 years of extensive experience in both hands on experimentation and management of advanced materials research and development, including polymers, ceramics, metals, and composites.
4. Since 2001, I have been employed by MER Corporation as Senior Vice President and technical manager of high thermal conductivity composites.
5. I am familiar with the subject matter of both the above-identified U.S. Patent Application and the Miyamoto et al. U.S. Patent No. 6,673,439.
6. In order to duplicate for thermal conductivity measurements the metal matrix composite materials containing SiC coated diamond particles as described in the Miyamoto et al. U.S. Patent No. 6,673,439, the following experiments were conducted under my supervision and direction.
7. A first sample of SiC coated diamond powder was prepared using the Miyamoto et al. process for conversion coating of diamond with SiO to duplicate Inventive Example 2 in Table 1 in Example 1 of the patent. An alumina crucible and lid was purchased. Grafoil was used for the carbon paper. A piece of grafoil was made to cover the bottom of the alumina crucible and another piece of grafoil was made to cover the circular walls of the crucible. A quantity of 4.76 grams of commercially available silicon monoxide (SiO) powder from Alfa-Aesar with a particle size of 400 microns or less was weighed out and placed on top of the grafoil in the bottom of the crucible. Next, a disk of 1/8" thick graphite felt was placed on top of the silicon monoxide powder. A quantity of 14.17 grams of SAT MS4-M diamond powder with a particle size of 30-40 microns was poured onto the 1/8" graphite felt. The ratio of diamond powder weight to silicon monoxide weight was 2.52, within the range

specified in Miyamoto et al., column 5, lines 50-52. Then another piece of grafoil was placed on top of the diamond powder, but not touching the diamond powder. The alumina lid was then placed on the crucible, such that it could be subsequently slipped off.

The loaded crucible was then placed in a Centorr vacuum furnace. The run conditions were a 2 hours ramp from room temperature to 1300°C, followed by a 2 hour soak at 1300°C. The sample was purged with Argon gas and run under vacuum of .01 torr or higher. This run was made on Wednesday, May 4, 2005. The top grafoil was removed from the crucible and the diamond powder carefully poured out. An XRD and SEM of the reacted powder were obtained.

8. A second sample of SiC coated diamond powder was produced using the chemical vapor deposition (CVD) coating process to duplicate Comparative Example 5 in Table 1 in Example 1 of the patent. A quantity of 3 grams of SAT MS4-M diamond (30-40 micron particle size) was placed in a graphite mesh basket. The reactor was induction heated using a graphite susceptor to 1300-1305°C at a pressure of 90 torr. A flow rate of 50 sccm (standard cubic centimeters per minute) of methyltrichlorosilane (MTS) with a flow rate of 150 sccm H₂ carrier gas was maintained for a period of 1 hour. A second run was completed using the same conditions to provide sufficient material for the composite preparation. An XRD and SEM of the reacted powder were obtained.

9. The samples of SiC coated diamond described in paragraphs 7 and 8, above, were used to prepare aluminum (Al) composites by the high pressure squeeze casting process. This process was chosen over the powder metallurgy composite forming process described in Example 3 of the Miyamoto et al. patent, in order to optimize the thermal conductivity properties of the resulting composites based upon past composite forming experience. The samples of the SiO conversion coated diamond and the CVD coated diamond powders were loaded into separate cavities of a graphite die. The cavities were of a size so as to produce a composite sample of ~0.5" diameter with a thickness of ~0.25". The die was loaded into a high pressure squeeze casting press. The processing parameters were a melt temperature of 850°C, die temperature of 625°C, and an infiltration pressure of 4 Ksi. After the casting process was completed, the die was removed from the press, and the excess Al surrounding the casting was removed by saw cutting and milling, with a final wet grinding until the Al infiltrated diamond was fully exposed on both faces of the samples. The loading of coated diamond in the Al was ~44%(volume).

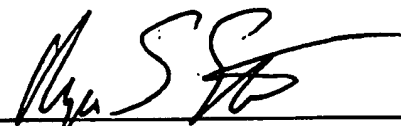
10. The Al/diamond composite samples described in paragraph 9, above, were sent to Prof. Richard Hasselman at Virginia Polytechnic Institute for measurement of thermal diffusivity. Dr. Hasselman is a recognized expert in the theory and measurement of thermal conductivity of materials. Thermal diffusivity values were converted to thermal conductivity levels using the relationship $K_c = \rho \cdot \kappa \cdot h$, where ρ is density of composite, κ is thermal diffusivity, h is specific heat, and K is thermal conductivity. Average density of the composite, ρ_c , was estimated using Archimedes principle and corresponded to

3.1g/cm³. Specific heat of the specimens, h_c , was directly measured by calorimetry and corresponded to 710J/k.kg. Measured values of thermal diffusivity and calculated values of thermal conductivity are shown below:

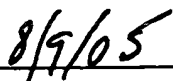
<u>Sample</u>	<u>K_g</u>	<u>K_g</u>
Conversion coating	0.64 cm ² /sec	141 W/mk
CVD coating	0.65 cm ² /sec	143 W/mk

11. The above results show that the metal matrix composite materials containing SiC coated diamond particles as described in the Miyamoto et al. U.S. Patent No. 6,673,439, do not necessarily or inherently exhibit thermal conductivity characteristics approaching the levels specified in the claims of the above-identified U.S. Patent Application, i.e., greater than about 300 W/mk to greater than about 600 W/mk. This is so whether the SiC coated diamond particles are prepared using the Miyamoto et al. process for conversion coating of diamond with SiO or using the CVD coating process described by Miyamoto et al. for comparison purposes, and even when optimizing the composite forming process for achieving maximal thermal conductivity characteristics.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine, or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



Roger S. Storm



Date

Signed in Tucson, Arizona

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Pickard et al.
Serial No.: 10/677,454
Filed: October 2, 2003

Docket No.: 7000Z
Group Art Unit: 1742
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For: High Thermal Conductivity Metal Matrix Composites

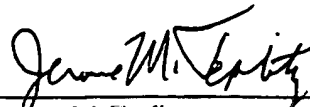
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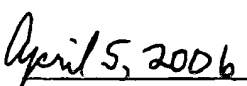
AMENDMENT

This is in response to the Office Action dated January 31, 2006.

CERTIFICATE OF MAILING (37 CFR 1.8)

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 5, 2006.


Jerome M. Teplitz


Date

CLAIM AMENDMENTS

(1) (currently amended): A composite structure comprised of a metal matrix having diamond particles dispersed therein, wherein said diamond particles are characterized by the presence of a layer of beta-SiC chemically bonded to the surface thereof, said composite structure having a thermal conductivity greater than about 300W/m.k., and wherein the metal matrix material is essentially either aluminum or magnesium.

(2) (canceled)

(3) (original): The structure of claim 1 wherein the metal matrix material is essentially aluminum.

(4) (currently amended): The structure of claim 1 wherein the metal matrix material is essentially ~~copper~~ magnesium.

(5 - 16) (canceled)

(17) (original): The structure of claim 1 wherein the carbon of the SiC is derived from the respective diamond particles to which it is bonded.

(18) (original): The structure of claim 1 wherein the diamond particles are in the size range of 100 - 120 microns.

(19 - 40) (canceled)

41) (previously presented): The composite described in claim 74, wherein the temperature to which the preform is heated is at least 1300 degrees centigrade.

42) (previously presented): The composite described in claim 74, wherein the temperature to which the preform is heated is at least 1400 degrees centigrade.

43) (previously presented): The composite described in claim 74, wherein the temperature to which the preform is heated is at least 1500 degrees centigrade.

44) (previously presented): The composite described in claim 74, wherein the temperature to which the preform is heated is at least 1600 degrees centigrade.

45) (previously presented): The composite described in claim 74, wherein the temperature to which the preform is heated is at least 1700 degrees centigrade.

46 – 50) (canceled)

51) (currently amended): A metal matrix composite comprising a matrix containing diamond powder, said diamond powder having a thin SiC surface layer on the respective diamond particles comprising said powder, said SiC layers being comprised of a conversion coating formed by a chemical vapor reaction of SiO with the respective diamond particles, and said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal employed is essentially either aluminum or magnesium.

52) (original): The composite described in claim 51, having a thermal conductivity greater than about 400W/m.k.

53) (original): The composite described in claim 51, having a thermal conductivity greater than about 500W/m.k.

54) (original): The composite described in claim 51, having a thermal conductivity greater than about 600W/m.k.

55) (original): The composite of claim 51, wherein the metal employed is aluminum.

56) (original): The composite of claim 52, wherein the metal employed is aluminum.

57) (original): The composite of claim 53, wherein the metal employed is aluminum.

58) (original): The composite of claim 54, wherein the metal employed is aluminum.

59) (original): The composite of claim 51, wherein the metal employed is magnesium.

60) (original): The composite of claim 52, wherein the metal employed is magnesium.

61) (original): The composite of claim 53, wherein the metal employed is magnesium.

62) (original): The composite of claim 54, wherein the metal employed is magnesium.

63-66) (canceled)

67) (previously presented): The composite described in claim 51, wherein the content of the SiC coated diamond powder in the composite is about 10-60 vol% of the total.

68) (previously presented): The composite described in claim 51, wherein the content of the SiC coated diamond powder in the composite is greater than about 70 vol% of the total.

69) (previously presented): The composite described in claim 51, wherein the content of the SiC coated diamond powder in the composite is greater than 80 vol% of the total.

(70) (previously presented): The composite described in claim 51, wherein the particle size of the diamond powder used is preferably about 50-150 microns.

(71) (original): The composite described in claim 51, wherein the particle size of the diamond powder used is preferably greater than 150 microns.

(72) (original): The composite described in claim 51, wherein the particle size of the diamond powder is greater than about 200 microns.

(73) (original): The composite described in claim 51, wherein the particle size of the diamond powder is greater than about 300 microns.

(74) (currently amended): A metal matrix composite containing diamond powder, said diamond powder comprising diamond particles having a thin SiC surface conversion coating formed thereon, such coating being formed by heating a preform of Si powder and diamond powder plus a binder, the purpose of said binder being to hold the Si in contact with the surface of the respective diamond particles, heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, and said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal comprising the matrix is essentially either aluminum or magnesium.

(75) (original): The composite described in claim 74, having a thermal conductivity greater than about 400W/m.k.

(76) (original): The composite described in claim 74, having a thermal conductivity greater than about 500W/m.k.

(77) (original): The composite described in claim 74, having a thermal conductivity greater than about 600W/m.k.

(78) (original): The composite described in claim 74, wherein metal comprising the matrix is aluminum

(79) (original): The composite described in claim 75, wherein the metal comprising the matrix is aluminum.

(80) (original): The composite described in claim 76, wherein the metal comprising the matrix is aluminum.

(81) (original): The composite described in claim 77, wherein the metal comprising the matrix is aluminum.

(82) (original): The composite described in claim 74, wherein the metal comprising the matrix is magnesium.

(83) (original): The composite described in claim 75, wherein the metal comprising the matrix is magnesium.

(84) (original): The composite described in claim 76, wherein the metal comprising the matrix is magnesium.

(85-89) (canceled)

(90) (previously presented): The composite described in claim 74, wherein the content of the SiC coated diamond powder in the composite is about 10-60 vol% of the total.

(91) (previously presented): The composite described in claim 74, wherein the content of the SiC coated diamond powder in the composite is greater than about 70 vol% of the total.

(92) (previously presented): The composite described in claim 74, wherein the content of the SiC coated diamond powder in the composite is about greater than about 80 vol% of the total.

(93) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is preferably about 50-150 microns.

(94) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 150 microns.

(95) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 200 microns.

(96) (original): The composite described in claim 74, wherein the particle size of the diamond powder used is greater than about 300 microns.

(97 – 106) (canceled)

(107) (currently amended): A high thermal conductivity substrate for LDMOS electronic packages, wherein the substrate is a metal matrix composite comprising a metal containing dispersed therein diamond particulates which have a thin SiC coating, said coating having been produced by a chemical vapor reaction process between gaseous SiO and the respective diamond particles, said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal employed for the metal matrix is essentially either aluminum or magnesium.

(108) (original): The substrate of claim 107, wherein the metal employed for the metal matrix is aluminum.

(109) (original): The substrate of claim 107, wherein the metal employed for the metal matrix is magnesium.

(110) (canceled)

(111) (original): The substrate of claim 107, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(112) (previously presented): The substrate of claim 111, wherein the metal employed for the metal matrix is aluminum.

(113) (previously presented): The substrate of claim 111, wherein the metal employed for the metal matrix is magnesium.

(114) (canceled)

(115) (currently amended): An electronic package containing an LDMOS chip bonded to a substrate with very high thermal conductivity, wherein said substrate is a metal matrix composite containing particulate diamond, and said particulate diamond has a thin SiC surface coating formed on the respective particles thereof by a chemical vapor reaction process between gaseous SiO and said diamond powder, said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal employed for the metal matrix is essentially either aluminum or magnesium.

(116) (original): The electronic package described in claim 115, wherein the metal employed for the metal matrix is aluminum.

(117) (currently amended): The electronic package described in claim 115, wherein the metal employed for the metal matrix is ~~copper~~ magnesium.

(118) (original): The electronic package described in claim 115, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(119) (previously presented): The electronic package described in claim 116, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(120) (previously presented): The electronic package described in claim 117, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(121) (currently amended): A high thermal conductivity substrate for LDMOS electronic packages, wherein the substrate is a metal matrix composite containing diamond particulates which have a thin SiC conversion coating, such coating being formed by heating a preform of Si powder and diamond powder plus a binder, the purpose of said binder being to hold the Si in contact with the diamond surface, and heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal employed for the metal matrix is essentially either aluminum or magnesium.

(122) (original): The substrate of claim 121, wherein the metal employed for the metal matrix is aluminum.

(123) (original): The substrate of claim 121, wherein the metal employed for the metal matrix is magnesium.

(124) (canceled)

(125) (original): The substrate of claim 121, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(126) (previously presented): The substrate of claim 125, wherein the metal employed for the metal matrix is aluminum.

(127) (previously presented): The substrate of claim 125, wherein the metal employed for the metal matrix is magnesium.

(128) (canceled)

(129) (currently amended): An electronic package containing an LDMOS chip bonded to a substrate with very high thermal conductivity, wherein said substrate is a metal matrix composite containing diamond particulates which have a thin SiC conversion coating, said coating being formed by heating a preform of Si powder and diamond powder plus a binder, the purpose of said binder being to hold the Si in contact with the diamond surface, and heating said preform to a temperature sufficient to cause the surface conversion reaction to occur, said metal matrix composite having a thermal conductivity greater than about 300W/m.k., and wherein the metal employed for the metal matrix is essentially either aluminum or magnesium.

(130) (original): The electronic package described in claim 129, wherein the metal employed for the metal matrix is aluminum.

(131) (currently amended): The electronic package described in claim 129, wherein the metal employed for the metal matrix is ~~copper~~ magnesium.

(132) (original): The electronic package described in claim 129, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(133) (previously presented): The electronic package described in claim 130, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(134) (previously presented): The electronic package described in claim 131, wherein the process utilized to consolidate the metal matrix composite is pressure squeeze casting.

(135) (original): An electronic package for high power applications, requiring very high thermal dissipation, comprising a composite structure as defined in claim 1 having a high thermal conductivity further characterized by the presence of a layer of aluminum nitride deposited on the surface thereof, said aluminum nitride providing an electrically insulating layer and also providing a high thermal conductivity path allowing for electronic chips to be bonded to the electrically insulating aluminum nitride layer, and also allowing electronic circuitry to be formed or deposited on the aluminum nitride.

(136 – 139) (canceled)

(140) (previously presented): The structure of claim 1, having a thermal conductivity greater than about 400W/m.k.

(141) (previously presented): The structure of claim 1, having a thermal conductivity greater than about 500W/m.k.

(142) (previously presented): The structure of claim 1, having a thermal conductivity greater than about 600W/m.k.

(143) (previously presented): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(144) (previously presented): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(145) (previously presented): The substrate of claim 107, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(146) (previously presented): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(147) (previously presented): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(148) (previously presented): The electronic package described in claim 115, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(149) (previously presented): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(150) (previously presented): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(151) (previously presented): The substrate of claim 121, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

(152) (previously presented): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 400W/m.k.

(153) (previously presented): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 500W/m.k.

(154) (previously presented): The electronic package described in claim 129, wherein said metal matrix composite has a thermal conductivity greater than about 600W/m.k.

REMARKS

In the Office Action dated January 31, 2006, the Examiner rejected claims 1, 2, 4, 17, 18, 41-45, 51-54, 63-77, 85-96, 107, 110, 111, 114, 115, 117-121, 124, 125, 128, 129, 131, 132, 134, 135 and 140-154. The Examiner also objected to claims 3, 55-62, 78-84, 108, 109, 112, 113, 116, 122, 123, 126, 127, 130 and 133 as being dependent upon a rejected base claim, but indicated that these dependent claims would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

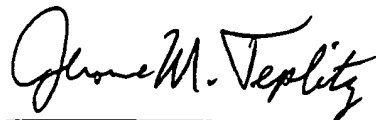
Of the rejected claims, claims 2, 63-66, 85-89, 110, 114, 124 and 128 have now been canceled by the present amendment. The claims now pending in the case are claims 1, 3, 4, 17, 18, 41-45, 51-62, 67-84, 90-96, 107-109, 111-113, 115-123, 125-127, 129-135 and 140-154. These pending claims can be broken down into the following seven sets:

- (1) Independent claim 1, and its dependent claims 3, 4, 17, 18, 135 and 140-142.
- (2) Independent claim 51, and its dependent claims 52-62 and 67-73.
- (3) Independent claim 74, and its dependent claims 41-45, 75-84 and 90-96.
- (4) Independent claim 107, and its dependent claims 108, 109, 111-113 and 143-145.
- (5) Independent claim 115, and its dependent claims 116-120 and 146-148.
- (6) Independent claim 121, and its dependent claims 122, 123, 125-127 and 149-151.
- (7) Independent claim 129, and its dependent claims 130-134 and 152-154.

Of the twenty-seven dependent claims indicated by the Examiner as being allowable if rewritten in independent form, claim 3 is included in set (1); Claims 55-62 in set (2); claims 78-84 in set (3); claims 108, 109, 112 and 113 in set (4); claim 116 in set (5); claims 122, 123, 126 and 127 in set (6); and claims 130 and 133 in set (7). The common allowable subject matter of these twenty-seven dependent claims relies upon the limitation that the metal matrix material is essentially either aluminum or magnesium. Accordingly, by means of the present amendment, Applicants have inserted that limitation into each of the seven independent claims 1, 51, 74, 107, 115, 121 and 129. Additionally, dependent claims 4, 117 and 131 have each been amended so as to be consistent with that limitation. Hence, all of the presently pending claims are now believed to be allowable.

For the foregoing reasons, it is submitted that claims 1, 3, 4, 17, 18, 41-45, 51-62, 67-84, 90-96, 107-109, 111-113, 115-123, 125-127, 129-135 and 140-154, all of the claims remaining in the case, are allowable, and that the application is now in condition for allowance. Reconsideration by the Examiner and an early notice of allowance are, therefore, respectfully solicited. If a telephone interview will advance the allowance of the application, enabling an Examiner's amendment or other meaningful discussion of the case, Applicants request the Examiner contact the undersigned at the number below.

Respectfully submitted,



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April 5, 2006

August 23, 2006



Registration No. 24315